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ON THE USE

OF

ARTIFICIAL TEETH

IN THE PREVENTION OF

INDIGESTION

AND THE CURE OF

DISEASES DUE TO IMPERFECT NUTRITION.

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BY

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"I am not at all sure that the increased longevity of modern generations is not, in some degree, attributable to the capability of chewing their food which the skill of the dentist prolongs to persons far advanced in life."—*Lectures on the Principles and Practice of Physic. By Sir Thomas Watson, Bart., M.D.*

PREFACE.

MANY of the principles which should guide us in the preservation of health and in the treatment of disease are so obvious, that they may be said to be self-evident. But, while these self-evident principles are readily admitted in theory, they are frequently disregarded in practice. The necessity of perfect mastication and the influence this is capable of exerting over the progress of disease is generally allowed; although the organs by which it can alone be effected are too often neglected. The invalid who is anxious that the physician should examine the condition of his heart, his lungs, and of almost every organ in his body, would regard an investigation into the state of his teeth as altogether superfluous.

The object of the present work is to call greater attention to this portion of general hygiene; and to impress upon the mind of the reader the injury to the health which arises from the absence of the grinding teeth, and the consequent impairment of the power of digestion.

75, Margaret Street,
Cavendish Square,
May, 1867.

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CHAPTER I.

INTRODUCTION.

THE old fable of the belly and the members contains a physiological truth, which is daily exemplified in the history of disease. If every individual enjoyed perfect digestion, together with a proper amount of food, the long catalogue of diseases which afflicts mankind would be materially diminished, and human life would be more frequently prolonged to its normal extent, than is the case in the present day.

The stomach is the organ in which the nutrient fluid is first elaborated from the food, whence it is transmitted to other organs whose office is to complete its final conversion into blood. If from any cause this primary fluid, or pabulum, is not properly constructed, an impure, or imperfectly formed blood necessarily circulates through the system, and a defective nutrition of the body is the result.

But, although the stomach is the laboratory in

which the food becomes dissolved, and in which the first step in the formation of the blood, is accomplished, there is yet a preliminary process taking place in the mouth, whereby the food is ground down, and mixed with the saliva before it is permitted to enter the stomach. It is upon the necessity of this preliminary process for the production of healthy digestion that we desire to insist, a process which is often strangely neglected, not only by invalids in general, but even by those who are actually suffering from all the miseries attendant upon dyspepsia.

The researches of the physiologist, and the investigations of the chemist alike concur in showing that the proper mastication and insalivation of the food is of the utmost importance. Persons who have what is commonly termed a weak digestion are generally conscious of the greater difficulty with which imperfectly masticated food is digested, compared with that which has been properly prepared for the action of the gastric juice. This, however, is not the case with the majority of those who are in the enjoyment of ordinary health, and who look upon such assertions as the mere refinements of

science, and of no practical value. These persons are apt to answer such statements by appealing to their personal experience, and will tell you, that although they have lost several teeth they have never suffered from indigestion. Such an argument is much the same, as if a man were to say that his horse could carry a certain weight, and, therefore, every other horse must be capable of doing the same. The answer to both is made by appealing from a single instance to a large number of cases. Moreover, our remarks apply not so much to the strong and healthy, as to those who are weak and delicate. There is as much difference in the digestive powers of different individuals, as there is in the development of their muscular systems; what one person may eat and drink with impunity, will induce a general disturbance of the system and a long train of suffering in others.

In regard to the particular subject of which we propose to treat, it must be remembered that dyspepsia may arise from various causes, and all we assert is, that loss of teeth is one of these causes. We will, however, venture a step further, and say, that in a large number of cases, from

whatever cause the dyspepsia may arise, the teeth will be found to be more or less defective. It may be that in many of these cases, the derangement of the stomach has preceded the loss of the teeth, for it is a fact, scarcely sufficiently recognised, that decay of the teeth is often superinduced by constitutional and acute disorders. When this happens, the disorder of the stomach is sure to be increased, and cannot be relieved until proper means have been taken to remedy the defective condition of the masticating organs.

"All chemical processes and the action of solvents is favoured by division of the matter to be operated on. Too rapid eating is a common cause of indigestion; and considerable masses of food, if not broken by the teeth, pass through the digestive canal unaltered, and deficient nourishment is the result, and this especially, if such masses be principally vegetable, or contain the skins of fruits and husks of grain."*

These are matters of daily occurrence, and are capable of receiving the most ample proof. To

* "Outlines of Physiology," by John Hughes Bennett, M.D., F.R.S.E., page 57, Edinburgh, 1858.

bring forward such proof, and to call greater attention to the intimate connexion existing between decay, or loss of the teeth, and those disorders which depend upon imperfect digestion and impaired nutrition is the object we have in view.

CHAPTER II.

ANATOMY OF THE ORGANS OF DIGESTION.

MAN'S body is in a state of perpetual change. Every movement, every act of secretion, in a word, every function that is performed by any of the organs, is accompanied by such changes in certain portions of the tissues that they are no longer fitted to fulfil the purposes for which they were originally intended. These changed and worn out particles are, therefore, cast off, while new ones take their place, destined to undergo a similar series of changes, and like their predecessors to be ultimately removed from the body.

The greater the energy and activity of the individual, the greater the destruction of his tissues. From this arises the necessity of food, which must be taken at stated intervals in order to supply the materials from which the waste of the body may be repaired, and the various organs preserved in a

healthy condition. In early life, while the individual is growing, more is added than is cast off; in the adult, and during the middle period of life, the amount added is not much in excess of what is lost; while in old age, what is added hardly compensates for what is daily destroyed.

In man, the function of nutrition consists of several separate and distinct operations, for the performance of each of which special organs are provided. In its most extended sense, this function includes not only the digestion of the food, but also the act of respiration, the circulation of the blood, and the assimilation of the nutrient particles by the different organs and tissues of the body. The latter are subjects we do not propose to enter upon, it is sufficient for our present purpose to consider that first stage, during which the food is converted by digestion into a semi-opaque thickish fluid, termed chyme, that is afterwards transformed into blood.

The digestive organs in man consist of three principal portions, the mouth, the stomach and the intestines. The first and second communicate with each other by means of a muscular canal,

known as the gullet, or œsophagus, which enters the left extremity of the stomach. The opposite extremity of the stomach, situated on the right side of the body, communicates directly with the intestines. Each portion has numerous glands appended to it, which assist in different ways in the digestive process.

The *mouth* is bounded at the sides and in front by the cheeks and lips; above by the hard palate in front, and posteriorly, where it communicates with the throat, by the soft palate, or velum, the two together forming the roof of the mouth; below is the floor of the mouth in which the tongue is placed, forming the organ of taste. In the upper and lower jaws are the dental arches, each consisting of sixteen teeth, arranged in pairs on either side of the central line of the face. A description of these organs will be given when speaking of their uses.

The mucous, or lining membrane of the mouth, including that portion covering the surface of the tongue, is provided with numerous small glands which secrete a tenacious fluid termed mucus. The whole of this surface is invested by a layer of flat

irregular-shaped scales called epithelium scales. New scales are constantly being formed at the bottom of the layer, while those at its outer surface are being as constantly cast off into the mouth, and assist in forming the fur that forms on the surfaces of the teeth and gums.

In addition to the mucous glands just mentioned, three pairs of salivary glands pour their secretions into the mouth; these are, the parotid, the submaxillary, and the sublingual.

The *parotid* is the largest of these glands, it is placed below the ear, between it and the back part of the lower jaw; it is this gland which is affected in mumps. A long duct passes off from the anterior border of the gland, which after proceeding forwards turns inwards, pierces the muscles of the cheek and the mucous membrane lining them to open into the cavity of the mouth opposite the second large grinding tooth of the upper jaw.

The *submaxillary* is the next in size, it is lodged in a depression on the inner side of the lower jaw, and gives off a duct which opens by the side of the frœnum of the tongue. It is from the orifices of these ducts that a little jet of saliva is occasionally

seen to issue on merely opening the mouth somewhat widely, it occurs, however, more frequently under the stimulus of savoury food.

The *sublingual* is the third and smallest of the salivary glands, it is placed along side the frænum of the tongue and differs from the other two, in pouring out its secretion through a number of minute pores instead of from a single duct.

It is the secretions of these three pairs of glands, together with the mucus from the mucous glands, which form the saliva. Hereafter, when speaking of the physiology of digestion, we shall find that the secretion of each of these glands possesses peculiar characters and properties enabling it to fulfil a different purpose in that portion of the digestive process, which is accomplished in the mouth by the aid of mastication.

We may pass over the œsophagus, by observing that it is lined with a continuation of the mucous membrane of the mouth, and is surrounded by muscles whose contractions propel the food into the cavity of the stomach.

The *stomach* is placed on the left side of the abdomen just beneath the ribs, extending across

partly into the right side; it is separated from the chest by the diaphragm through which the œsophagus passes. The stomach is the most dilated portion of the alimentary canal, and has an elongated globular form; it varies in size in different individuals, and also in the same individual according to the amount of distension it undergoes from the presence of food. The right extremity opens into the intestines and is termed the pyloric opening, or gate through which the food passes after it is digested. Like the œsophagus, the stomach is lined by mucous membrane containing numerous small cells, or glands, some of which secrete the gastric juice and others the mucus that is being constantly poured into the stomach. It is surrounded by muscular fibres, whose contractions propel the food from the left to the right side, and *vice versâ* until it has been so changed by the chemical action of the gastric juice that it is in a fit state to pass into the intestines.

The *intestines* commence at the pyloric, or right extremity of the stomach, and like that organ are lined by a mucous membrane containing a large number of glands, they are also surrounded by

muscular fibres whose contractions give to them a peculiar vermicular movement, which is most active after food has been taken. The intestines are divided into the small and large intestine; the first are about twenty feet in length, the second about five feet.

The large glands connected with the functions of digestion, are the liver and the pancreas.

The *liver* secretes the bile; which is conveyed into a special reservoir termed the gall bladder, the latter being furnished with a duct opening into the small intestine at a short distance from its commencement near the right extremity of the stomach.

The *pancreas* also secretes a peculiar fluid which, in its chemical properties, bears some resemblance to the saliva; this fluid is conveyed by a duct which joins that of the gall bladder, and the two together enter the intestine.

CHAPTER III.

THE CHEMISTRY AND PHYSIOLOGY OF DIGESTION.

The advances which have been made of late years in chemistry and in physiology, have afforded us a very clear insight into the general process of the digestive function, and into the changes the food undergoes and by which it is rendered subservient to the nutrition of the body. We shall confine our remarks principally to that preliminary process which takes place in the mouth, consisting of the mastication and insalivation of the food.

Before, however, describing these processes, we must say a few words on the distinction the chemist has established between the different kinds of food, distinctions that are intimately connected with the way in which the food is digested, and the purposes to which it is applied in the nutrition of the body.

Of the numerous elementary substances with which we are acquainted, comparatively only a

few enter into the composition of our bodies. These elements are oxygen, hydrogen, carbon and nitrogen; sulphur and phosphorus; to these elements must be added some of the salts of potash and soda, and a few other mineral substances such as the carbonate and phosphate of lime, iron, &c.

If a portion of muscle is analysed, it is found to consist of oxygen, hydrogen, carbon and nitrogen, united in certain proportions together with a small quantity of inorganic salts. If, on the other hand, a portion of fat is analysed, it is found to contain only oxygen, hydrogen and carbon, the essential difference between the two substances being the absence or presence of nitrogen, hence in a chemical point of view, the components of the body may be divided into the nitrogenous and the non-nitrogenous.

The same distinction holds good as regards the various articles of food, which may be also divided into the nitrogenous and the non-nitrogenous. To the first belong all kinds of flesh, albumen or white of egg, the sinews, tendons, and ligaments of animals, also the cartilage or animal substance of bones. A certain amount of nitrogenous food is also contained in many substances obtained from the vegetable

kingdom; this is the case with wheat flour, peas, beans, &c.

To the second belong all oils, fats, sugars, the various forms of starchy or amylaceous substances, such as arrow root, tapioca, sago, rice, and potatoes. Even wheat flour, peas, and beans, although they have been mentioned among the vegetable substances supply nitrogenous food, contain a still greater proportion of non-nitrogenous food. This division also includes alcoholic fluids.

The following table gives the proportions of the nitrogenous and non-nitrogenous, or carbonaceous, forms of food contained in some members of the vegetable kingdom most frequently consumed by man.*

100 lbs. contain	Water and Ashes	Nitrogenous secretions.	Carbonaceous secretions.
Wheat	7	23	70
Barley	17	14	69
Oats	20	11	69
Rice	11	3	86
Maize	12	7	81
Peas	19	29	52
Beans	17	31	52
Lentils	19	33	48

* "Vegetable Substances used for the food of Man," p. 20, London, 1846.

These two classes of food fulfil different offices in the body. The nitrogenous assist in building up the tissues, and animals are found to require more or less food in proportion as the compounds containing nitrogen are less or more abundant in it. The second serve to maintain the heat of the body, and constitute what is termed respiratory food.

These views as to the uses of the food were first brought forward by the distinguished German Chemist, Baron Liebig; but they have since undergone considerable modifications and indeed, at the present time, the opinions entertained as to the uses of food may be said to be in a state of transition. However these inquiries may terminate, the fact as to the composition of the food will still remain the same: namely, that some foods contain nitrogen and some do not, and as we shall presently see, there is also a difference as to the mode in which the two kinds of food are digested. Most foods are made up of a mixture of the nitrogenous and the non-nitrogenous substances, thus, even flesh contains a certain amount of fat, and in wheat there is sixty-one parts in a hundred of starchy

matter,* and only a little more than twelve of nitrogenous substances.

The first step in the process of digestion is the mastication and insalivation of the food. The chemist is well aware that if he wishes to dissolve a metal in an acid, that he will accomplish his object more rapidly by minutely dividing the metal, simply because a larger surface is thereby exposed to the action of the acid. In the same way the thorough mastication of the food facilitates the action of the gastric juice, and this is still further assisted by the softened condition of the food from its being impregnated and moistened by the saliva. So far we have merely a mechanical effect, but we must now refer to the chemical changes which are superinduced by the action of the saliva in certain articles of food belonging to the non-nitrogenous division.

It is extremely difficult to ascertain in man the actual amount of saliva that is secreted, and consequently the estimates that have been made by different writers vary considerably. According to Bidder and Schmidt, three pounds of saliva are

* See Miller's "Chemistry," Vol. III, page 111.

secreted on an average in the twenty-four hours; it is probable that this estimate is much below the actual amount.

We have seen that three pairs of glands are concerned in the secretion of the saliva, and we have now to learn that the fluid secreted by each pair of glands has distinct properties and special duties assigned to it in the insalivation of the food. These facts have been principally ascertained by direct experiments upon the lower animals, and from certain diseased conditions in man. Tubes have been passed into the ducts of the glands, and their secretions have by this means been collected separately, while in man the proper opening of the parotid gland has occasionally become closed up, and a fistulous opening formed upon the cheek, through which the secretion of the gland has been discharged externally.

The secretion from the sublingual glands is transparent, very viscid, and adheres to whatever it comes in contact with; it resembles the fluid or mucus secreted by the small glands scattered over the surface of the tongue and mucous membrane of the lips and cheeks. The thick viscid nature of

this fluid when mixed with the food serves to facilitate its passing through the fauces.

The secretion from the submaxillary glands is less viscid than that from the sublingual, but more so than that from the parotid. Experiments have shown that this secretion is directly connected with the sense of taste. It is poured out in abundance when savoury or stimulating food is received into the mouth.

The secretion from the parotid glands is fluid and limpid, but in a short time loses its transparency and becomes slightly opaque. This secretion is directly connected with mastication, and is only discharged into the mouth when that process is going on. The size of the glands is in proportion to the importance of the act, being most developed when the food is derived from the vegetable kingdom, and when it is also hard and dry. The quantity of this fluid, and the effect of mastication on its discharge, have been strikingly illustrated by experiments on the vegetable feeding animals. In the horse, mastication takes place alternately on the two sides; if tubes are placed so as to collect the secretion of the parotid glands,

it is always most abundant on the side where mastication is going on. Thus, on one occasion, there was collected from that side two pounds and a half of saliva, while the opposite side yielded less than half a pound. When the act of mastication was changed, there was collected in the same time from the latter side nearly two pounds of saliva, and from the first only a little more than half a pound.*

The secretions of these glands in health are naturally alkaline. To them must be added that of the mucous glands of the lips, cheeks, and tongue (p. 8), the whole of them together forming the mixed saliva of the mouth. Naturally this mucus is also alkaline, but it is very prone to decompose and to become acid. According to Magitot, the secretion from that portion of the mucous membrane covering the lips and gums is naturally acid even in healthy people, and when

* In the ruminating animal, when the food is returned into the mouth, it is the saliva of the parotid glands alone which is secreted for the purpose of completing its mastication. While when the food is first taken into the mouth, it is principally the saliva from the submaxillary glands which is secreted.

this condition is excessive and not neutralised by the other secretions, it gives rise to caries of the teeth.*

The mixed saliva of man contains from 986 to 993 parts of water in 1,000. Its reaction in a state of health is alkaline, but there are many diseases in which it becomes acid, foremost amongst them may be mentioned dyspepsia and other disorders of the stomach. The effect of this acid condition of the saliva is to destroy the teeth by caries, and to deprive the person of the powers of mastication while it is most important in all these diseases that this preparation of the food should be carefully and properly performed.

The solid matters of the saliva consist of inorganic and organic. Amongst the former, is phosphate of lime which, together with mucus and epithelial scales, forms the tartar or salivary calculus that collects around the necks and on the crowns of the teeth.

The organic constituents of the saliva are very numerous, but the only one we shall notice is a

* "La Salive considérée comme agent de la Carie dentaire." Par le Docteur Magitot, page 10, Paris, 1866.

peculiar substance known as *salivary diastase.** This substance possesses the property of producing certain changes in the starchy matters contained in the vegetable substances employed as food, by which they are capable of being digested in the stomach. If the starchy matters are not so acted upon, they pass out of the stomach and are only digested when they reach the intestines and have been submitted to the influence of the secretion derived from the pancreas, and which we have previously seen is discharged into the intestine through the duct common to that gland and the liver. The pancreas is often spoken of as a supplementary salivary gland, and its secretion is found to contain the peculiar substance which has just been mentioned as salivary diastase.

What is known as fecula, starch, or amylaceous

* "During the germination of seeds, the starch undergoes a species of fermentation, and is converted first into dextrine, and subsequently into sugar, in which state it is assimilated by the young shoot. This conversion is due to the action of a peculiar ferment, termed *diastase*, which is formed in all germinating seeds. One part of this substance suffices to convert 2,000 parts of starch into dextrin, and subsequently into sugar."—Miller's "Chemistry," Vol. III, page 79, 2nd Edition.

matter, when examined by the microscope, is seen to consist of oval flattened grains surrounded by an external envelope marked with a number of concentric rings. It is these grains which pass through the stomach without being digested, unless they are thoroughly masticated, so as to break down the outer investing membrane and allow of its contents being acted on by the diastase of the saliva. This substance appears to perform the part of a ferment which ultimately converts the starch into a sweet substance, termed starch sugar or glucose, and it is not until this change has been effected that the starch can be digested and appropriated for nutrition, a change, be it remembered, which the gastric juice itself is incapable of effecting.

This property of the saliva has been proved by direct experiment. Schwann digested in some acidulated saliva, for twenty-four hours, a certain quantity of boiled starch, then filtered the fluid, and having neutralised it and evaporated to dryness, he obtained from the residue, by means of alcohol, a considerable quantity of sugar which he recognised by its taste, as well as by its property of fermenting with yeast.*

* Müller's "Physiology," Vol. III, page 396.

As regards the flesh of animals and the other forms of nitrogenous food, these are acted on mechanically by mastication, and moistened by the saliva, but it does not appear that any chemical change is effected in them in the mouth. Mastication and insalivation simply prepare them for the action of the gastric juice, but at the same time, this preparation is very necessary for their easy digestion. Another circumstance to be remembered is, that in the act of mastication air becomes mixed with the saliva and the food, which passing with them into the stomach assists in the work of digestion.

The gastric juice which is poured out most abundantly when food is introduced into the stomach, contains two very important elements, namely a free acid and a peculiar principle termed *pepsin.* The pepsin enables the gastric juice to dissolve the different kinds of flesh and albuminous substances, such as eggs and that portion of milk which is coagulated by the free acid. Just as the diastase of the saliva acts the part of a ferment in regard to the amylaceous or starchy components of the food, so the pepsin of the stomach per-

forms the part of a ferment with respect to the nitrogenous or albuminous materials, and as the diastase of the saliva is most abundant in the vegetable feeders, so the pepsin of the gastric juice is most abundant in the flesh feeding animals.

The action of the gastric juice therefore reduces the albuminous and fibrinous constituents of the food into a liquid form, but leaves the fatty matters unaffected as well as the starchy matters, unless the latter have been previously acted upon by the saliva.

The fluid formed by the action of the gastric juice upon the food is termed chyme, from the stomach the chyme passes into the intestines, where it meets with the bile and the secretion of the pancreas. The first acts upon the fatty substances of the food forming them into a kind of emulsion; the latter upon such portions of the starchy materials as have escaped the previous action of the saliva.

The chyme is thus converted into what is called chyle; this is absorbed from the surface of the intestines, and passed into the veins by which it is

conveyed to the lungs, where it is finally converted into blood. From the lungs the blood is transmitted to the heart by whose agency it is distributed through the arteries to the different parts of the body.

CHAPTER IV.

USES OF THE TEETH. EFFECTS OF THEIR LOSS.

THREE distinct purposes are fulfilled by the teeth in man; 1st. they add to the personal appearance; 2nd. they assist in the pronunciation of certain articulate sounds; 3rd. they serve to divide and masticate the food. It is with the latter office only that we are specially concerned on the present occasion.

We have previously said that there are sixteen teeth in each jaw, arranged in pairs on either side of the central line of the face. Those of the two jaws correspond to each other, but are marked by certain characters which distinguish them from each other.

These sixteen teeth are divided into four classes. Incisors, Canines, Bicuspids or small grinders, and Molars or large grinders.

The *Incisors*, or cutting teeth, are four in number, situated at the front of the mouth and serve for the separation or first division of the food. They are broad, flat teeth in the upper jaw, terminating in sharp cutting edges. Those in the lower jaw are narrower and more wedge shaped.

The *Canines*, two in number, are placed one on either side of the incisors. These teeth are largely developed in the lion, the dog, and similar animals, hence the origin of their name. They are also termed the eye teeth, from a false but popular notion there is some direct connection between them and the eye. They are also named the cuspidati, or pointed teeth, a character which especially belongs to those of the upper jaw.

The *Bicuspids*, or small grinders, two in number, are placed next to the canines. The name bicuspis, or two pointed, especially applies to those of the upper jaw. These commence the comminution or grinding down of the food, which is completed by the next series.

The *Molars*, or large grinders, the most important of all the teeth in regard to mastication, are three in number. They are named respectively the first,

second, and third molar commencing from before backwards. The two first are much the largest, while the third which varies both in form and size is often termed the *wisdom* tooth, on account of its late appearance, occasionally not coming through the gum until thirty, forty or even fifty years of age.

The crowns of the first and second molars in both jaws are large square-shaped bodies, surmounted by four or five tubercles which interlock with those of the opposite jaw in such a manner as to secure the complete division and mastication of the food.

The teeth of the two jaws are so arranged, that those of the lower come within the circle formed by those of the upper when the mouth is closed; the six front teeth in the upper jaw, overlapping the corresponding teeth in the lower jaw. Occasionally the lower teeth come in front of the upper, producing a very unsightly appearance. When this is the case, the person is said to be underhung.

It is the molar teeth which are especially concerned in the act of mastication, and in reducing

the food to that state of minute subdivision which prepares it for the action of the gastric juice. Everything connected with the anatomy of the jaws and mouth is admirably adapted to ensure the complete accomplishment of this preliminary act. The teeth themselves are firmly implanted in the jaw bones, and their fangs are so directed and arranged as best enables them to resist the pressure exerted upon them by means of the powerful muscles of mastication. The jaws are strengthened at this part, and a large surface provided for the attachment of the muscles.

Several pairs of muscles are concerned in the act of mastication, and their combined action is such as to give a kind of half rotatory motion to the lower jaw, the effect of this is to cause the crowns of the lower teeth to glide over the surfaces of those in the upper jaw, and as their tubercles pass in and out of the corresponding depressions in the opposite teeth, the particles of food are effectually crushed and divided.

It has been previously mentioned that it is opposite the second molar tooth of the upper jaw that the duct of the parotid gland opens. The presence

of food serves as a stimulus to the gland, and causes it to secrete the saliva at such times in great abundance, while the movements of the muscles which close the jaws propels the secretion along the duct and discharges it into the mouth, just at that part where mastication is going on, and where therefore the saliva becomes directly mingled with the food.

Such are the arrangements which nature has provided in order that the act of mastication may be thoroughly performed before the food is allowed to pass into the stomach, and yet how often, from various causes, such as the loss or decay of the teeth, the press and hurry of business, from the habit of hastily swallowing the food are her intentions thwarted, and all her care rendered of no effect. Is then the act of mastication after all of such secondary importance that it may be neglected with impunity, and is food in large masses as readily digested as that which has been prepared in the way nature intended?

The teeth of the two jaws are so arranged, that when the mouth is closed each tooth comes in contact with two of those in the opposite jaw. The

advantages derived from this disposition is, that if a tooth should be lost, the corresponding tooth in the opposite jaw is not rendered entirely useless, because it is still partially antagonized by one of the opposing teeth. If, however, two neighbouring teeth are lost, then at least one of the teeth in the opposite jaw is no longer capable of assisting in the process of mastication. In consequence of the loss of its antagonists, the tooth begins to lengthen, or rather a deposit of bone takes place at the bottom of the socket, and the tooth is gradually protruded, entering the vacant space in the opposite jaw until it is ultimately expelled by the efforts of nature from the mouth.

Again, when a tooth is lost, the neighbouring teeth have an inclination to fall into the vacant space, and thus lose their original and natural position in the jaw, the consequence is they cannot so advantageously resist the pressure of the opposite teeth in mastication. The slant the tooth has acquired from the loss of its neighbour is increased by mastication, while the undue pressure it receives arising from its irregular position, often sets up a kind of chronic inflammation of the membrane

covering of the fang, and eventually the tooth is lost, although it may be entirely free from decay. The same thing may occur in the case of every tooth that is lost. Thus, the absence of two or three teeth will in reality involve the complete derangement of all the teeth, and instead of the person being deprived of the use of two or three of his teeth, the majority of them may become so misplaced that mastication is rendered extremely defective.

The loss of any of the six front teeth produces so marked a change in the personal appearance, and often causes such an impediment to the pronunciation of certain words or letters, that it needs little persuasion to induce the person to have them replaced. The first small grinder being situated next to the canine, its loss is almost as perceptible as that of any of the six front teeth; here again, personal appearance will often suggest the desirability of having the tooth replaced, and occasionally the same feeling will prevail with regard to the second small grinder. It is, however, far otherwise with respect to the large grinding teeth; these are out of sight, and therefore their loss is

too often entirely disregarded; yet it is precisely these teeth that we have seen are so essential to mastication, and whose loss must consequently exercise the greatest influence upon the general health. Unfortunately it is also the molar teeth which are most liable to be lost; out of 3000 teeth which were extracted at the Middlesex Hospital, no less than 1,124 were first molars and 637 second molars, the two together constituting considerably more than half the entire number of the teeth extracted. In another table, it is shown that 2,500 of these 3,000 teeth were lost by the time the patients were forty years of age.*

The same fact is shown from the records of the dental operations performed at St. George's Hospital. In 8,708 cases of extraction of the permanent teeth, 6,138 were removed before the patients were thirty years of age. Out of the same number 5,112 consisted of the first and second large grinding teeth, and if we were to include the second bicuspid or second small grinding tooth, and the third large grinder or wisdom tooth, this number would amount to 7,155, showing the enormous

* See Tomes' "Lectures on Dental Surgery," page 140.

proportion which the grinding teeth bear to the entire number lost. When, also, we consider the early period at which these teeth were removed, we cannot help feeling that many of the diseases from which the working population suffer, even in the prime of life, and which are so often dependant upon defective nutrition, may in a great measure be referred to this early loss of the teeth.*

It is not, however, necessary that the teeth should be actually lost, in order that they should give rise to all the ill effects we have referred to; it is quite sufficient that they should be decayed and tender. Some of the worst cases that have

* Until within these few years, the labouring classes were entirely excluded from the benefits of conservative dentistry, the only remedy they could have recourse to in all cases of toothache was extraction. Two Hospitals are now established in London, the one in Great Portland Street, the other in Soho Square, where the poor, on the recommendation of a subscriber, can have their teeth properly attended to, by which in a very large number of cases the necessity of extraction is avoided. The writer would strongly urge upon the public the propriety of supporting these institutions, which, notwithstanding the large number of patients who annually apply for relief, are languishing for want of funds.

come under our notice have been those in which the molar teeth were merely decayed, but in which the decay had advanced so far that not only were the crowns of the teeth exceedingly tender, but the membrane around the fangs was also affected and subject to periodical attacks of inflammation. At these times the teeth become so tender, that it is impossible to use them in mastication, and the consequence is, the food has to be swallowed in large masses, unmixed with the saliva, and all the bad effects resulting from the passage of imperfectly masticated food into the stomach are certain to ensue.

There is also another injurious result arising from the presence of these decayed teeth. More or less of the enamel being removed from the surface of the tooth, the softer kind of bone forming the mass of the tooth is exposed to the action of the saliva and of the various fluids received into the mouth. These agents soften and destroy the exposed surface, which is thereby converted into a soft, pulpy substance, which becomes mingled with the fluids of the mouth, and passing into the stomach along with the saliva

produces the very worst effects upon the function of digestion and upon the general health.

There is no more frequent cause of severe neuralgic pains about the head and face than the presence of a number of these decayed teeth, exposing the patient not only to months but to years of intense suffering, which is only relieved by the gradual loss of the teeth. Indigestion, constant headache, earache, and general derangement of the health are often entirely dependant upon the same cause.

CHAPTER V.

ON SOME OF THE DISEASES THAT ARE PRODUCED OR AGGRAVATED BY THE WANT OF PROPER MASTICATION AND INSALIVATION OF THE FOOD.

HAVING spoken in general terms of the function of digestion, and more particularly of the part performed by the teeth and the salivary glands in preparing the food for the action of the stomach, we shall now take a brief review of some of the diseases which are more especially influenced by the absence or imperfect performance of this preliminary step in the process of nutrition.

The most frequent of these disorders is that which is commonly known under the name of *Dyspepsia*, a term which signifies difficulty of digestion. This term is evidently only descriptive of the most prominent symptom, and marks the seat to which the sufferings of the patient are principally referred. Difficulty of digestion is a symptom which sooner or later accompanies every disease of the stomach;

but as the term dyspepsia is usually employed, it is confined to those cases in which the impaired digestion is not accompanied by any actual organic disease of the stomach, such as ulceration, cancer, &c., but in which there is only functional derangement.

The symptoms accompanying dyspepsia are so various and so multiform that it is hardly possible to enumerate them all. They may consist of merely a sensation of discomfort and a feeling of distension about the region of the stomach soon after taking a meal, or to these may be added flatulence, the eructation of an acid or watery fluid, actual and severe vomiting, together with headache, lassitude, and general derangement of the system. Attacks of dyspepsia often give rise to great bodily depression and lowness of spirits; the patient is overwhelmed with a feeling of despondency for which he can assign no reasonable cause, but which, together with his actual sufferings, render life a burthen for the time.

The symptoms may, therefore, be divided into local and general. The first are referred to the stomach, and consist of uneasiness, pain, the eruc-

tation of watery or acid fluids, flatulence, nausea, and vomiting. The second would appear principally to affect the nervous system, and through that, the neighbouring organs. Sometimes pain is referred to the region of the heart; at other times the action of the heart is increased, and a strong pulsation is felt either in the heart itself or in the large vessels of the chest and throat; while at other times, on the contrary, its action is temporarily suspended. The breathing is frequently oppressed, amounting occasionally to a sense of suffocation, and the patient is convinced that he is suffering from serious organic disease. After a time, that is, when the food has passed out of the stomach into the intestines, or has been expelled by vomiting, the symptoms subside only, however, to return on again taking food. These attacks often come on at night after the patient has retired to rest, and are then attended with distressing and frightful dreams, from which he starts up in alarm, or the sleep is of that uneasy kind that in the morning he wakes up unrefreshed and unfitted for the duties of active life.

Several forms of dyspepsia are described by

different writers, the distinction between them depending either upon the conditions under which the dyspepsia occurs, or the predominance of some particular symptom. It is not our intention to notice all these varieties, nor to dwell minutely upon any of them, but only to select such points in their history and treatment as may serve to illustrate the views we have been advocating in regard to mastication and insalivation. The forms we shall notice are: 1. simple dyspepsia; 2. dyspepsia accompanying congestion of the mucous membrane of the stomach; 3. dyspepsia attended with an unnatural craving for food, termed bulimic dyspepsia; 4. flatulent dyspepsia; 5. fermentative or acid dyspepsia; 6. the dyspepsia of gout and rheumatism; 7. the dyspepsia of phthisis; 7. sympathetic dyspepsia.

1. *Simple dyspepsia.* There are few persons passed the age of maturity who have not experienced attacks of dyspepsia in some of its milder forms, such as a feeling of oppression or distension in the region of the stomach, eructation, a slight amount of flatulency, or a burning sensation in the throat, commonly known as heartburn,

and often accompanied by the discharge of a watery or limpid fluid in the mouth, constituting what is termed water-brash. These attacks may occur in the young and robust, in whom all the organs of the body are healthy, and depend upon excess in either eating or drinking, or it may be in both. In all such cases abstinence will speedily effect a cure, and the remedy is clearly in the hands of the patient himself.

As men advance in years, without going to actual excess, they are apt to indulge in the luxuries of the table so as to tax the digestive powers beyond their capabilities. Such men pay the penalty of their indiscretions by suffering from some of the milder forms of dyspepsia. It often happens in these cases that the majority of the grinding teeth are lost, and that in consequence mastication is very imperfectly and hastily performed. When this is the case, the use of artificial teeth, combined with moderation and the administration of a simple tonic will generally effect a cure.

Closely allied to the above is what is termed *slow digestion*; it is attended with much the same

symptoms. The sensation of weight and oppression lasting for several hours after taking a meal, and is caused by the food remaining an unusual time in the stomach. It occurs in literary men, in persons of sedentary habits, and in those whose brains are over-taxed by work or anxiety. "Eating too rapidly is a common exciting cause of this disorder, as is also imperfect mastication from loss of teeth."*

Under the same heading, may be included the dyspepsia arising from general weakness of the system. The food remains in the stomach, but there is no power to digest it. There is the sensation of weight and oppression before mentioned, together with headache, faintness, and a feeling of giddiness, and nausea. In persons of middle age, these symptoms are often relieved by flatulence, sickness, or diarrhœa; but in old and feeble individuals, they are often followed by very serious results; the functions of the brain becoming disturbed, the patient is attacked with giddiness and

* "Imperfect Digestion," by Arthur Leared, M.D., M.R.S.A., 3rd. Edit., p. 99.

dimness of sight, followed by loss of consciousness and apoplexy.

We have previously mentioned (p. 11) that when food is passed into the stomach, the contractions of its muscular layer or coat propel the food from its left to its right side, and from thence back to the left side, these revolutions being completed in from one to three minutes. These movements continue until the food has been thoroughly acted on by the gastric juice and reduced to a semi-fluid condition, when it is allowed to pass into the intestines. The movements are greatly facilitated by the proper mastication of the food, and if this is neglected or imperfectly performed, it is of itself sufficient to give rise to dyspepsia.

The muscular structure of the stomach is sometimes so weakened or wasted, that the organ becomes enormously distended and is unable to contract upon its contents. Under these circumstances, it is evident that if large masses of imperfectly masticated food are transmitted to the stomach, the dyspepsia produced by the want of action in the muscular fibres must inevitably be greatly aggravated.

2. *Dyspepsia connected with chronic inflammation of the stomach.* There are certain conditions of the system in which more blood is conveyed to the mucous membrane of the stomach than is usual in a state of health. The muscular action of the stomach is disturbed, the gastric secretions deranged, the tongue habitually furred, and there is a disagreeable taste in the mouth. There is frequently nausea and vomiting, the eructation of sulphuretted hydrogen causing the patient to have the flavour of bad eggs. According to Dr. Habershon, three principal symptoms mark this form of dyspepsia: 1. tenderness at the pit of the stomach; 2. irritability of the stomach: and 3. a desire for cold drinks.

3. *Bulimic* dyspepsia.* In most forms of dyspepsia the appetite is defective, and there is a disinclination to take food. In the present form, on the contrary, there is an inordinate desire for food. The patients suffer from constant hunger, and within an hour or two after a good meal a sensation of emptiness of the stomach comes on, accom-

* Derived from two Greek words: *Bous* an ox, and *limos* hunger.

panied with faintness and lowness of spirits. In this form constipation is habitually present, but in some cases there is diarrhœa.

4. *Flatulent dyspepsia.* As the name sufficiently indicates, this kind of dyspepsia is accompanied by the generation of an enormous quantity of gaseous matter in the stomach immediately after taking food. Writers are not agreed upon the source from whence the accumulation of gas is derived; some consider it is an exaggerated condition of the gases which are naturally secreted in the intestinal canal; others that it is derived from the fermentation of the food; but as Dr. Graves remarks, in these patients, whether vegetable or animal food is taken, the development of the gaseous matters occur with equal rapidity. The patient suffers from constant distension of the stomach, and can at any time by the slightest effort eruct a large quantity of wind.

Possibly both the causes mentioned are in operation, and it is quite certain that imperfectly masticated food, especially when it is of a vegetable nature and contains a large quantity of amylaceous or starchy matter, tends to increase the disorder.

5. *Acid dyspepsia.* The predominant symptom in these cases, is the undue formation of the acid secretions of the stomach soon after food has been taken. The secretion is discharged into the mouth; it has an intensely sour taste and sets the teeth on an edge; heartburn is constantly present; and sometimes a rancid, oily-like fluid is eructed, having the flavour of bad butter, and accompanied with a burning sensation at the back of the throat.

6. *The dyspepsia of gout and rheumatism.* "Gout," says Dr. Tanner, "may be defined as a specific inflammation, having a constitutional origin, and being much favoured by an hereditary taint. It is accompanied by great pain and swelling of the affected joint, fever and general disturbance, and especially by *some disturbance of the digestive organs.*"*

The older writers were in the habit of speaking of gout in the stomach, and many persons still suppose that the disease may suddenly leave every other part of the body and be transferred to the

* "The Practice of Medicine," by T. H. Tanner, M.D., F.L.S., 5th Edit., p. 125.

stomach. Although the researches of the pathologist have shown that these views are no longer tenable, and as Sir Thomas Watson remarks, "*gout* (so called) *in the stomach* has sometimes turned out under the test of an emetic, to have been nothing more than *pork in the stomach*," still the fact remains that a special form of dyspepsia often occurs in these patients. The gastric juice is unnaturally acid, heartburn is constantly present, there is pain at the pit of the stomach, the tongue is furred, and the patient exhibits extreme irritability.

Seeing, then, that gout may be attended by a special form of dyspepsia, and knowing how frequently any irregularity or imprudence in eating or drinking may be followed by a paroxysm of the disease, it becomes an important question, how far the want of mastication, in certain states of the system, may assist in bringing an impending "fit of the gout" to a crisis.

Rheumatism is also dependant upon a diseased condition of the blood, with a superabundance of lactic acid in the system. There are two forms of the disease, the acute and the chronic. Speaking of the treatment of the latter form of the

disease the author just quoted says, "All sufferers from chronic rheumatism should wear flannel, and beware of exposure to damp and cold. They must also be careful of their diet, and should particularly avoid beer and heavy wines; as I am convinced that many paroxysms of this disease are brought on through disorders of the digestive organs."*

7. *The dyspepsia of phthisis.*—In order to understand the important bearing which imperfect digestion may have upon the development of consumption, it is necessary to be acquainted with the nature of this disease. Consumption, or phthisis, consists in the deposit of a peculiar substance termed 'tubercle' in the tissues of the lungs; it is first exuded in a fluid form from the minute blood vessels, it then becomes consolidated, and acts the part of a foreign body, setting up irritation and inducing all those alterations in the structure of the lungs which attend upon this distressing and fatal malady.

"The symptoms which *precede* the occurrence of tuberculosis are generally indicative of disorder of the digestive organs. Dr. Wilson Philip first no-

* *Opus cit.*, page 149.

ticed that there were some forms of indigestion, which ended in phthisis; and it has more recently been proved by Mr. Jonathan Hutchinson and others, that the peculiar feature of this dyspepsia consists in the difficult assimilation of fatty matters. Sugar, fat, and even alcohol "turn acid, giving rise to sour eructations, heartburn and flatulence."* We learn then, from this, two things; first, that consumption is the result of imperfect nutrition, and, secondly, that it is often preceded by derangement of the digestive organs. Of all the diseases which the physician is called upon to treat, phthisis is one of the most difficult, and if its progress is to be arrested, or its fatal termination delayed, the only hope of doing this is by treating it in its very earliest stage. In all these cases, the great object is to improve the faulty nutrition, so as to restore the blood to its healthy condition, and by that means prevent the deposit of tuberculous matter.

In the majority of consumptive patients, the teeth sooner or later, fall into a most deplorable condition from the ravages of decay, very often hardly one of them being left in a sound condition. The teeth

* *Opus cit.*, page 105.

and gums are exceedingly tender, so that mastication is most imperfectly performed. At the same time, as far as my experience goes, these decayed teeth do not give rise to those attacks of acute pain which occur in other cases, and which induce the patient to seek the advice of the dentist. The consequence is, that the condition of the mouth is apt to be entirely neglected, and all the injurious effects arising from the food not being properly masticated are allowed to aggravate the disease of the lungs, and still further weaken the exhausted and debilitated system of the patient.

Sympathetic dyspepsia.—Most persons have experienced the influence of depressing and melancholy news in arresting the appetite, and in temporarily depriving the stomach of its powers of digestion. Injury of the brain is frequently followed by vomiting, while vomiting itself is often attended with giddiness and pain in the head, showing the intimate connexion or sympathy which exists between the two organs.

The diseases of other organs, such as the liver, heart, kidneys, and uterus, also exercise a powerful sympathetic influence over the functions of the sto-

mach. The disordered stomach necessarily re-acts upon the disease of the organ that is primarily affected, and increases the sufferings of the patient. Hence the necessity of carefully attending to the condition of the stomach, and providing the patient with food that is easily digested, as well as with the means of properly masticating it if the grinding teeth are lost.

Other diseases of a more fatal character attack the stomach, such as ulceration, cancer, cirrhosis, &c. It is not, however, our intention to enter upon the consideration of these maladies, but shall merely observe that whatever has been said in regard to the mastication of the food in relation to dyspepsia, applies, if possible, with still greater force to these more fatal disorders of the gastric cavity.

Treatment.

The treatment of dyspepsia may be arranged under the three heads of—1. Hygiene; 2. Diet; 3. Therapeutics.

Hygiene, under this head, is included all that in-

fluences the general health, such as fresh air, a proper amount of exercise, rest, early hours, relaxation from business, freedom from anxiety, regularity in the meals, and a proper amount and quality of the food.

The question of food is, however, of such importance in the present class of disorders, that instead of being included in the general treatment, it requires to be specially considered, and forms one of the principal means of cure.

Therapeutics. To this division belong the various drugs, or *materia medica*, employed by the physician to combat the different symptoms as they arise in these protean forms of disease. It would be entirely beyond the scope and intention of the present work to enter upon these matters, which properly belong to the domain of the physician, or of the medical attendant of the patient. Our object is to call attention to the advantages to be derived from the employment of artificial teeth in the treatment of diseases of the digestive organs, believing, as we do, that although the necessity of mastication is admitted as a general principle—as the passages we shall presently quote from some of our leading au-

thorities sufficiently show—yet that it is not so strongly or systematically insisted upon as it should be.

That while a careful examination is constantly made of nearly every other organ of the body, the condition of the teeth is often overlooked, and while full and minute directions are given as to his diet and the hours of his meals, the patient is, at the same time, frequently left without the power of properly masticating his food.

Diet. Of all the means at our command for the successful treatment of dyspepsia and the diseases attending upon defective nutrition, that of diet is the most important, and, consequently, we find every writer on these subjects laying down the most stringent rules in this respect. Food of a proper quality taken at proper intervals in due quantities, if properly masticated and thoroughly mixed with the saliva, will, in many cases, accomplish a cure. It may, therefore, be of service if we give a dietary suitable to these cases, and for this purpose we shall avail ourselves of the general directions which Dr. Tanner has laid down on this subject in his "Practice of Medicine."

7.0 A.M.—A tumbler full of equal parts of milk and soda, or of milk and lime-water.

7.30 A.M.—To get up. Use a tepid or cold sponge-bath; rub the skin thoroughly with a coarse towel. Dress leisurely.

8.30 A.M.—Breakfast. A large cup of weak tea with half milk or milk and water. Sole or whiting; or the lean of an underdone mutton chop; or a new-laid egg lightly boiled. Stale bread and a little fresh butter.

1.0 P.M.—Luncheon. Oysters (conditionally that they agree) or an underdone mutton-chop, or a slice out of a roast leg of mutton, provided meat has not been taken for breakfast. A biscuit, or stale bread. One glass of sherry. Or, if there be little or no appetite, a raw egg beaten up in sherry and water, with a small biscuit, will be useful.

6 P.M.—Dinner. Cod-fish, smelts, turbot, or brill. Mutton, venison, chicken, grouse, partridge, hare, pheasant, tripe boiled in milk, sweetbread, boiled leg of lamb, or roast beef. Stale bread. Cauliflower, asparagus, vegetable-marrow, French beans, sea-kale. Half a wine-glassful of cognac in a bottle of soda-water. Two glasses of good sherry or of claret after dinner. A few grapes, an orange, a baked apple, or strawberries may be taken, if desired.

9 P.M.—A small glass of cold brandy-and-water, with a biscuit; or a cup of weak tea with half milk, and a

little bread-and-butter; or a teacupful of milk-arrowroot.

11.0 P.M.—Bed. To sleep on a mattress, without too much covering. The room to be properly ventilated. A fire will be very beneficial in cold weather. It is presumed that a good night's rest has been earned, by a fair amount of exercise in the open air.

Speaking of the diet in the dyspepsia arising from weakness, Dr. Habershon says, "as to the proper diet, it will often be found that the stomach may be spared very much by the use of fluid diet, by *farinaceous* food."* In the dyspepsia from congestion of the mucous membrane of the stomach, he says "soups and the forms of nitrogenous diet most easy of digestion, may be tried; but generally bland *farinaceous* food best suits the patient;"† and again, in regard to diet, in what he terms inflammatory dyspepsia: "the most bland forms of diet are desirable, and those articles which tax all the energies of the stomach to dissolve them should be avoided, as solid animal food, animal soups, and

"On Diseases of the Stomach." By S. C. Habershon, M.D., page 116, London, 1866.

† *Idem*, page 137.

even beef tea, are often injurious, whilst *farinaceous* substances are well borne."*

The same physician, when speaking of the remedies for indigestion, says, "imperfect mastication greatly increases the work of the digestive organs; for when the portions of aliment are thoroughly divided, they are more easily dissolved by the gastric secretions; and when left in large crude masses they remain in the stomach even for many days, irritating and producing severe spasmodic pain. The action of the saliva upon the starchy portions of *farinaceous* food is also facilitated when sufficient time is allowed for the food to be thoroughly mixed.†

As regards the diet in the dyspepsia of phthisis, Dr. Brinton recommends "small and frequent doses of milk, or meat broth, with *farinaceous* food."‡

Dr. Leared, when speaking of the treatment of dyspepsia by diet, amongst other observations says,

* "On Diseases of the Stomach." By S. C. Habershon, M.D., page 152.

† *Idem*, page 94.

‡ "Lectures on the Diseases of the Stomach." By W. Brinton, M.D., F.R.S., page 353. London, 1864.

"cheese or pastry should not be taken; but light *farinaceous* puddings seldom disagree, except in acid dyspepsia, when they are apt to increase the acidity."* The same writer, when enumerating the causes of dyspepsia, has the following important remarks: "Under the head of the relation of food to the organs may be placed the effects of insufficient *mastication.* It is a fruitful source of dyspepsia, and is more frequently the result of haste and carelessness, than inevitable from the state of the teeth. The great prevalence of dyspepsia in the United States has been attributed to the rapid but characteristic manner in which meals are there dispatched. In some employments, the insufficient time allowed for meals is, for the same reason, a cause of disturbed digestion, and too often gives rise to permanent disease."

"Besides actual loss of teeth, soreness of them, or of the gums, sometimes attended by unhealthy and even fetid secretions, greatly interfere with mastication. It is most important that solid food should be duly prepared by chewing for the action of the

* *Opus jam cit.*, page 155.

stomach; and it is also important that the starchy elements of food be sufficiently submitted to the action of pure saliva."*

Again Dr. Tanner says, "The most frequent causes of dyspepsia are the use of food in too large a quantity, or of an improper nature; or the imperfect mastication of it from carelessness, or owing to the pain of bad teeth, &c."†

We have previously seen that the farinaceous or starchy forms of food are precisely those which it is most important should be carefully masticated and mixed with the saliva, and yet it is just this kind of food which is recommended as best adapted to the dyspeptic. One writer advises that the patient who is making use of farinaceous food, should suck a small pebble, or chew a piece of india-rubber, so as to excite a flow of saliva, and allow it to pass into the stomach.

How important is it, therefore, that in all these cases the condition of the mouth should be ascertained. First, in order that all diseased teeth should be either stopped or removed; and

* *Opus jam cit.*, page 35.

† *Opus jam cit.*, page 459.

secondly, where the grinding teeth are lost, that their place may be supplied by artificial teeth, in order to restore, as far as possible, the power of mastication, so that the food—whether derived from the animal or the vegetable kingdom—may be transmitted to the stomach in the best possible condition for its speedy and easy digestion.

CHAPTER VI.

ON THE CONSTRUCTION AND APPLICATION OF ARTIFICIAL TEETH.

Of the various appliances which man's ingenuity has devised for the restoration of parts of the body which have been lost, artificial teeth alone really perform the function which devolved upon the natural organs. In the present instance, this function being purely mechanical, namely, that of grinding or dividing the food, artificial teeth are capable of replacing, in a more or less perfect manner, the natural organs, and of performing the work which nature has assigned to them. And, as we have previously seen, they even accomplish something more, and indirectly influence the chemical changes taking place in digestion. The movements required for the grinding action produce at the same time the discharge of the saliva from the parotid glands, whose action on the starchy ingredients of the food has been previously explained.

Before supplying a patient with artificial teeth, it is necessary to inquire into the state of his general health, and to carefully examine the condition of his mouth and of the remaining teeth. This is especially the case with regard to persons who suffer from headache and periodical attacks of neuralgia, and also with regard to those whose principal object in having artificial teeth is to enable them to masticate their food.

The alluring advertisements which are daily paraded before the public, promising the insertion of artificial teeth without the extraction of any decayed teeth or stumps, are mere snares and delusions. It is not so much for the purpose of facilitating the insertion of the artificial teeth, that the conscientious practitioner advises the extraction of such diseased teeth, as on account of the injury they so often inflict upon the health of the patient. With the various appliances which the dentist has at his command in the present day, there are few cases where artificial teeth may not be constructed, and rendered comfortable without the removal of any remaining decayed teeth or stumps. At the same time, it must be distinctly understood that no condition of the

mouth is so favourable for this purpose as when the natural teeth have been removed, and sufficient time has elapsed for the absorption of the sockets, and for the gum to have become firm and hard.

It is not, however, necessary that every stump should be removed, there is almost as much difference between what the dentists speak of, as a 'healthy stump,' and one that he terms an 'unhealthy stump,' as there is between a decayed tooth and a sound tooth.

In some mouths, after the crown of the tooth has been destroyed, the further progress of the disease seems to be arrested, the stump becomes of a dark colour, but at the same time somewhat more transparent than it was originally, a deposit of earthy matter gradually takes its place in the substance of the bone, rendering it denser, and enabling it to resist the action of the fluids of the mouth. Such stumps will often remain for many years undergoing little or no change, and causing no inconvenience to the patient. Far otherwise is it in regard to the unhealthy stump. In these cases, when the crown of the tooth has been destroyed, the disease is in no way arrested, but proceeds gradually to destroy the

central portion of the stump, softening the bone, and reducing it to a kind of pulpy consistency. The hollow cavity of the stump becomes the receptacle of minute particles of food, and of the fluids of the mouth.

The saliva being very prone to undergo decomposition, every condition is thus provided which favours a rapid process of decomposition, the proceeds of which necessarily pass along with the saliva into the stomach. This state of things gives an odour to the breath that is extremely unpleasant to other persons, and at the same time often produces the most injurious effects upon the health of the individual himself. Very frequently, while this process of decomposition and decay are going on in the hollow of the stump, there is at the same time inflammation of the periosteum or membrane covering its outer surface, and placed between it and the socket. This inflammation gives rise to the formation of pus, which gradually oozes out around the circumference of the fang on the surface of the gum. If the inflammation instead of extending over the whole surface of the fang, is confined to its apex, then the pus, instead of passing away at the sur-

face of the gum, accumulates at the bottom of the socket, the latter becomes enlarged, and a swelling forms, usually towards the outer surface of the alveolus, constituting what is familiarly termed a 'gum-boil.'

After awhile, an opening occurs at the most prominent point of the swelling, the pus is discharged through it into the mouth, and the patient, who has been suffering more or less during the formation of the gum-boil, obtains a temporary relief. We say temporary relief, because in nearly all these cases there is a succession of attacks, often extending over a period of two, three or even more years, until the stump is so diminished that it is finally thrown off from the surface of the gum. During the whole of this time the patient is subject to paroxysms, similar to the one just described. Constant pain, varying in duration from about three to ten or twelve days, then a bursting of the gum-boil, followed by relief, and a period of tranquillity, which varies in length according to the health of the patient, the state of the weather, or any of those external or internal conditions which exert so direct an influence over a diseased part, whether it is a decayed

tooth, an ulcerated surface, or any other local disorder.

Even these are not all the evils and inconveniences that may arise from the retention of diseased teeth or fangs of teeth in the mouth. Every now and then, what is termed a fistula forms on the the face; that is to say, an opening is established on the cheek, or in the course of the lower jaw, through which pus or matter is discharged. Such a discharge may depend upon the presence of diseased bone, but very often it is entirely owing to a dead tooth, or it may be only the dead stump of a tooth remaining in the jaw. When the discharge arises from the presence of diseased teeth, it is liable to be attributed to disease of the bone, an error in diagnosis that leads to a course of treatment, which, failing to attack the real source of the discharge, affords not the slightest relief. Amongst several other cases of this kind the following have come under my notice.

A lady, past fifty years of age, had been subject for more than two years to a constant discharge near the angle of the lower jaw, on the left side, producing not only great annoyance, but also much

suffering, and seriously affecting the general health. During that time, the patient had been residing at some distance in the country, and had been under medical treatment. The cause of the discharge was attributed to the presence of a piece of dead bone, and the patient was assured that when that came away the discharge would be arrested, the opening heal up, and her sufferings cease. At the end of that time, she fortunately came to reside in London, and consulted Mr. Carr Jackson, who, on examining the mouth, detected the presence of a tooth at the back of the left side of the lower jaw, but completely hidden beneath the gum, and only to be detected by probing. Having ascertained this, Mr. Jackson recommended the patient to consult me.

Upon examining the mouth, I found every tooth was lost, but at the posterior part of the lower jaw, on the left side, were the remains of the stump of one of the molar teeth, probably the second; this, however, was not the cause of the fistula. On passing the probe beneath the gum towards the back of the jaw, I was able to confirm Mr. Jackson's diagnosis. There was no doubt that this hidden tooth, or portion of a tooth, was the cause of all the mis-

chief. It was, therefore, determined that this tooth should be extracted. The operation was extremely difficult, as I had the sense of touch alone to guide me in its performance, the tooth being entirely out of sight. The patient was not in a condition to have chloroform, but nevertheless she bore the operation, which was extremely painful, most heroically. After the removal of the tooth, and when the patient had recovered from the immediate effects of the operation, her health rapidly improved; the pains about the head and face disappeared, the discharge ceased, and, under medical treatment, she speedily regained her health, and in a short time visited me for the purpose of having a lower set of teeth.

Not the least curious part of the above case is, that all the mischief was caused by the wisdom tooth, which had never made its way through the gum; but was, nevertheless, in a state of decay.

The second case was somewhat similar, and occurred in a healthy looking man, who was a gatekeeper on a railway in Lincolnshire. For three years he had had a discharge from the left side of the

lower jaw, about midway between the chin and the angle of the jaw. The general health was a good deal affected, he was unable to masticate on that side of the mouth, and suffered great annoyance from the discharge; he had been under two or three medical men, who all referred the discharge to disease of the jaw bone. In June 1865, he came to London with a view of having the dead bone removed. Upon examining the interior of the mouth, I found as I expected a diseased tooth. The crown of the first molar, on that side of the lower jaw, was gone, and only the fangs remained. This tooth was, in fact, the source of the discharge, and I therefore at once removed it; the second molar was also much decayed next the cheek, and as it might continue to be a source of irritation and tend to keep up the discharge, I considered it better to remove that tooth also.

The operation was performed on the 27th of June; the patient returned home the same day. A week after, I had a letter from him, saying that his face was much better. On July 22nd, he writes, "I am thankful to be able to inform you that since my return I have not had any

pain. Can eat on that side well; it has not healed up on the outside, but has not discharged anything since my return." In August the patient informed me that the face was quite well, and that his health was daily improving.

The history of these cases forcibly impresses upon us the importance of referring a disease to its true cause. In both instances, the patients had been needlessly exposed to years of suffering and ill-health, the whole of which might have been avoided by simply removing the diseased teeth.

When time and cost are not a consideration, the decayed teeth should be removed, and as soon as the gums are partially healed, and the extreme tenderness which necessarily follows these operations has subsided, a temporary piece of artificial teeth should be made to be worn until the mouth has thoroughly healed and the projecting edges of the sockets been removed by absorption. When this has taken place, and it may be some weeks or even months before the process is complete, a proper set of artificial teeth should be adjusted to the mouth.

It is, however, impossible to lay down any ab-

solute rule as to the removal of the stumps or of the decayed teeth that may remain. The dentist must be guided in each individual case by a careful consideration of all the attendant circumstances, such as the condition of the teeth themselves, whether headache or neuralgia is present, the state of the general health, and the natural constitution of the patient.

During the last few years, greater advances have been made in mechanical dentistry than at any previous period. Formerly, bone, natural teeth and gold were the materials employed; in the present day the two former are almost discarded, their place being supplied by vulcanite and mineral teeth. Vulcanite is in every respect superior to bone, since, it is not only capable of being adapted more accurately to the mouth, but it is at the same time perfectly indestructible. Mineral or porcelain teeth are now made in such a variety of shapes, colours, and sizes, that the teeth remaining in the mouth can always be accurately matched, or if all of them are lost, the artificial substitutes, if applied in an artistic manner, will restore the natural appearance of the

countenance as well as the power of mastication.

As a rule, the best material to be employed in the upper jaw, especially where only a few teeth are required, is gold, which, on account of its thinness, occupies less space than vulcanite. When a whole upper piece is required, and it is to be retained in position by suction, that is to say, by the pressure of the atmosphere, then vulcanite often presents special advantages in these cases, which more than counterbalance the objection arising from its increase in thickness.

When a whole upper piece of artificial teeth is required, and it is supported by springs attached to a piece in the lower jaw, then by far the most perfect form of artificial denture is a gold plate accurately fitted to the gums and palate with mineral teeth attached to it by means of vulcanite. The advantage presented by this mode of attaching the teeth, is that no apertures are left between the individual teeth, and, consequently, there are no spaces in which the particles of food can accumulate. For cleanliness and durability this is, therefore, the most perfect arrangement which can be made.

The shape of the lower jaw, or rather of the alveolar processes with their covering of gum where the teeth have been lost, is so different to that of the upper, that here vulcanite can often be used more advantageously and with greater facility and comfort to the patient than gold. The upper jaw presents a broad, flat surface, which, excepting on the outer sides, that is, next the cheeks, where there is frequently a considerable accumulation of soft mucous membrane, is not so liable to yield to the pressure of the wax or whatever is employed in taking the impression of the mouth.

On the contrary, on both the outer and inner sides of the lower jaw, there is a considerable quantity of soft mucous membrane, which assists in forming the floor of the mouth, and which readily yields to pressure. The jaw itself, instead of forming a flat surface, is of a conical form, and, consequently, if there is any yielding of the parts from the pressure of the artificial teeth, in sinking they come upon a wider part of the jaw than that to which they were originally fitted or intended to rest upon. When this hap-

pens, it is necessary there should be sufficient thickness in the artificial piece to allow of its being cut away, so as to adapt it to the part of the jaw upon which it is made to rest by the pressure of mastication.

The application of a single artificial tooth is generally required where one of the six front teeth has been lost; this occurs most frequently in the upper jaw. Sometimes it is also required in the case of the first or second small grinders. Let us suppose that the loss has occurred in the upper jaw, and that it is one of the central teeth. We have already stated that a gold plate is best adapted for the upper jaw. In the case of a central incisor, if there is a gap on either side of the mouth, then the plate should be carried to the vacant space whether a tooth is inserted or not, merely for the purpose of affording a firm support to the artificial tooth. If all the teeth are present, still the plate should be carried for some distance behind the backs of the other teeth for the reason already assigned.

Nothing is more to be condemned than the practice—and it is a very common one—of attach-

ing a single artificial tooth to a small gold plate, which only passes as far as the back of the neighbouring tooth on either side of the artificial tooth, and trusting to a hard gold wire clasping around the front part of the same tooth on a level with the gum. Such an arrangement is almost sure to injure the neighbouring teeth sooner or later. Let anyone consider the enormous power possessed by the lower jaw, and he will understand what a strain must be exerted upon the artificial tooth when any hard substance is placed between the upper and lower front teeth. This strain must necessarily be supported by the neighbouring teeth; if it is confined to two teeth it is injurious, but if distributed over the surface of several teeth, no harm will result to them.

When two or three front teeth are lost, the same remarks apply as in the case of a single tooth, and in some respects with even greater force, since the greater the number of the teeth the greater will be the leverage exerted by those of the lower jaw.

The lower front teeth are seldom lost until a late period of life, and when several of the back

teeth are also gone; we are, therefore, rarely called upon to replace these teeth only.

Nevertheless, it does sometimes happen that one or two of the front lower teeth are lost from an accident. The plate should be continued behind the backs of two or three of the neighbouring teeth, but at the same time nothing like the same amount of force is exerted upon these teeth in mastication compared with what occurs in the case of the upper jaw.

With regard to the restoration of a single small grinder in the upper jaw, although it is objectionable to limit the extent of the gold plate to the backs of the two neighbouring teeth, still as the lower teeth bite on to the crowns of those in the upper jaw, the pressure is directed more upwards than outwards, and therefore there is less strain upon the neighbouring teeth than when the defect occurs at the front of the mouth.

It is not often that only one of the small grinders has to be replaced in the lower jaw; generally speaking, some of the large grinding teeth are wanting at the same time. When it does occur, the same remarks would apply as

those we have just made in respect to the upper jaw.

We come now to the large grinding teeth, those which it has been shown are so important in mastication, and whose loss so seriously affects the functions of digestion and nutrition.

The loss of these teeth may be confined to one side of either the upper or lower jaw, or it may extend to both, this will depend very materially upon the age of the patient. Our remarks will be confined to those cases where the teeth are lost on both sides of either the upper or lower jaw.

These are the cases where it is so desirable that there should be no delay in replacing the lost organs by artificial teeth, before the stomach becomes weakened by the additional work thrown upon it from the want of proper mastication. It may also be added that they form some of the most successful cases in mechanical dentistry.

In the upper jaw, a gold plate should be extended from side to side of the mouth, across the palate, and behind the backs of the remaining

teeth. By this means not only is a firm support obtained, but the pressure of mastication is evenly distributed over the mouth. After a time no inconvenience is felt from the presence of the artificial teeth, while the power of digestion is not only preserved, but when it has become impaired, constituting a case of simple dyspepsia, it will be restored. In all the forms of dyspepsia we have noticed, a marked relief will be afforded to the gastric symptoms, and the patient placed in the most favourable condition to reap the benefits to be derived from medical treatment.

In the lower jaw, vulcanite alone with mineral teeth may be employed, or a combination of gold and vulcanite. As in the upper jaw, the teeth on the two sides must be connected together by a band passing behind the backs of the teeth remaining at the front of the mouth. The objection which some persons have to the use of vulcanite alone, is that the thickness required to give it the necessary strength causes it to fill up the mouth and come in the way of the tongue. In these cases, gold may be used to go behind the remaining teeth, and connect the two sides to-

gether, while vulcanite is employed at the back of the mouth, where the teeth are to be replaced. The advantage of the vulcanite is, that broad, well-rounded edges are provided to rest upon the margins of the gum, while in the event of the piece sinking in the mouth, it can be more safely cut away than if a thin plate of gold were employed.

There is one other method of attaching artificial teeth which requires to be briefly noticed. We refer to the principle of atmospheric pressure, by which is produced what are commonly known as suction pieces.

Everyone is aware that the atmosphere surrounding our globe produces a very considerable amount of pressure on all bodies with which it comes in contact. This pressure is exerted in every direction, so that the position of the object makes no difference in the action of the force that is exerted upon it. Under ordinary circumstances, all the surfaces of a body being exposed to an equal amount of pressure, no perceptible result is produced, but if by any means one of the surfaces is excluded from this pressure, a very different condi-

tion arises. Thus, for instance, if the surfaces of two plates of glass are accurately ground and adapted to each other so that no space is left between them, or, if having ground them as accurately as we can, the surface of one of them is greased and the two plates are pressed together, it will require a considerable amount of force to separate them, because the whole weight of the atmosphere is exerted in keeping them together.

It is this principle or natural force arising from the pressure of the atmosphere which has been employed to retain artificial teeth in the mouth and, where it can be successfully applied, is certainly the most perfect and at the same time the most simple method of doing so.

It is this plan which is so constantly paraded before the public by the advertising dentist, and often claimed as the special invention of the advertiser, but happily the principles of physical science are open to all, and what one person can accomplish another can do also.

Unfortunately this principle of atmospheric pressure as a means of attaching artificial teeth is limited in its application, and however theory may

represent it as a certain and unerring method, in practice it is found only to answer in certain cases. It is unnecessary, in a popular work, to enter into details, explaining why atmospheric pressure does not answer in every instance, it is sufficient for the reader to know that such is the case, and for us to add that the success or failure of the plan mainly depends upon the form and condition of the mouth, and that the dentist is guided by his practical experience as to the particular cases in which he can rely upon it.

We have thus laid down the general principles which should guide us in the treatment of cases where the patient is suffering from decay or loss of the teeth. But there are cases which daily present themselves in practice, where the advice we have given in regard to the preparation of the mouth cannot be carried out, sometimes from the extreme weakness of the patient, but more frequently from want of courage to submit to the operation. In some of these cases the difficulty may be overcome by the use of chloroform, or of Dr. Richardson's ether spray; but there are also many cases in which the patient's avocation

will not permit him to give the necessary time.

Are we, then, to refuse any assistance in these cases because we cannot do all we should wish, or all that the strict principles of surgery dictate? The medical practitioner does not refuse to palliate where he cannot cure, nor does he generally dismiss a patient because he will not strictly adhere to the advice he has given him. Neither do I consider that the dentist is called upon to refuse to treat such cases as are now referred to, where a reasonable amount of benefit can be conferred upon the patient.

Much may be done to improve the condition of these patients without removing the teeth, such, for instance, as filing away all projecting edges and sharp points, until the stumps are level with the gum, clearing out all soft decay, and ordering the mouth to be cleansed two or three times a day with an antiseptic and detergent wash. When these precautions have been taken, a gold plate can generally be adapted to the upper jaw and worn with comfort. This is not the case with regard to the lower jaw; here the employment of what is known as soft vulcanite will often meet the

requirements of the case. This kind of vulcanite has the toughness and yielding character of new leather, and will frequently enable a patient to use artificial teeth, which he could not do if only gold or hard vulcanite was employed.

Patients who purpose wearing artificial teeth should understand that the benefit to be derived from their use must partly depend upon themselves. Two, three, or more teeth may often be placed in the upper jaw with scarcely any trouble to the patient. It is, however, very different where a number of back teeth have to be inserted in both the upper and lower jaws for the purpose of mastication. In these cases, the patient must be prepared at first to put up with some inconvenience, until the teeth are properly adjusted and he has become accustomed to the presence of the foreign body in his mouth. With only a moderate amount of perseverance, all these discomforts are in a short time surmounted, and the patient soon reaps the benefit of his improved powers of mastication.

There is, however, a source of failure which must be carefully guarded against. The majority

of patients who require artificial teeth have acquired the habit of swallowing their food in large masses, in consequence of their inability to masticate it. This practice is often continued from mere habit after the patient is provided with artificial teeth; the consequence is, that meat and similar articles of food are not reduced to that state of minute division and pulpy consistence which so greatly facilitates the action of the gastric juice upon them, nor is the starchy or amylaceous food allowed to remain a sufficient time in the mouth for the saliva to effect those changes which we have previously explained, and which are necessary for its digestion in the stomach. The same habit may, however, be induced if the artificial teeth are productive of pain in mastication; the patient to avoid this rapidly swallows his food, and thus badly fitting or ill-constructed teeth may really become a cause of the very evil they are intended to obviate.

Every one who wears artificial teeth should be scrupulously careful to prevent the accumulation of all foreign matters, whether derived from the mouth itself or from the food. The proverb tells

us that cleanliness is next to godliness, and it is a saying which such persons would do well to bear in mind, especially those who are troubled with dyspepsia or any other form of gastric disorder. We all know that from the outer surface of our bodies, what is called the scarf skin is constantly being cast off. In the same way the so-termed epithelial scales are cast off into the mouth, and when artificial teeth are never or rarely removed, these scales necessarily accumulate beneath them, there they pass into a state of decomposition, and not only produce an offensive condition of the breath, but often cause the surface of the mucous membrane to become inflamed and exceedingly tender. I have in some cases seen ulceration and the formation of pus arise from this cause.

It is, therefore, very desirable that artificial teeth should be frequently taken from the mouth, not only for the purpose of removing any adhering particles of food, but also that the mouth itself may be properly cleansed and the continued accumulation of these dead portions of the mucous membrane prevented. The mouth should be rinsed with water, to which a small quantity of lavender water, or *eau*

de Cologne has been added; if there are any remaining teeth, these should be carefully brushed, and the artificial teeth thoroughly cleansed from all foreign substances before they are replaced.

Many persons suppose there is great difficulty in the removal and replacement of artificial teeth; if, however, they are properly constructed this is rarely the case. In fact, the great test of good construction may be said to be the facility with which the artificial teeth can be removed from the mouth and replaced by the patient himself.

Although some kind of attachment to the remaining teeth is required, it is not necessary there should be any strain upon them. The artificial teeth should be retained in the mouth by the close adaptation of the plate to which they are attached to the surface of the gums quite as much as by any extension of it over the natural teeth; acting on the principle as we have already explained when speaking of suction pieces. When these precautions are taken and the patient observes the rules that have been laid down for him, he is far more likely to retain his remaining natural teeth than if they had been left without assistance in the work of masti-

cation. Nothing is more common when the back teeth have been lost for some time, than to see all the front teeth of the upper jaw loosened and thrust out of place by the pressure exerted upon them by the lower teeth in mastication, or, indeed, even in closing the mouth. The back teeth being gone, the action of the powerful muscles which close the mouth exercise the whole of their force upon the front upper teeth by bringing those of the lower jaw fórcibly against them.

We shall conclude our remarks with the following quotation from Hufeland's "Art of Prolonging Life," which sums up in a few words the benefits to be derived from the proper mastication of our food, and clearly indicates the remedy when this has become impossible from the premature loss of the teeth.

"We are taught by experience," says Hufeland, "that all those who attained to a very great age had a good appetite which they retained to the last. For good digestion, good teeth are extremely necessary, and one therefore may consider them among the essential properties requisite for long life, and in two points of view: First, good and

strong teeth are always a sign of a sound, strong constitution and good juices. Those who lose their teeth early have, in a certain measure, taken possession of the other world with a portion of their bodies. Secondly, the teeth are a great help to digestion, and consequently to restoration."

THE END.

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